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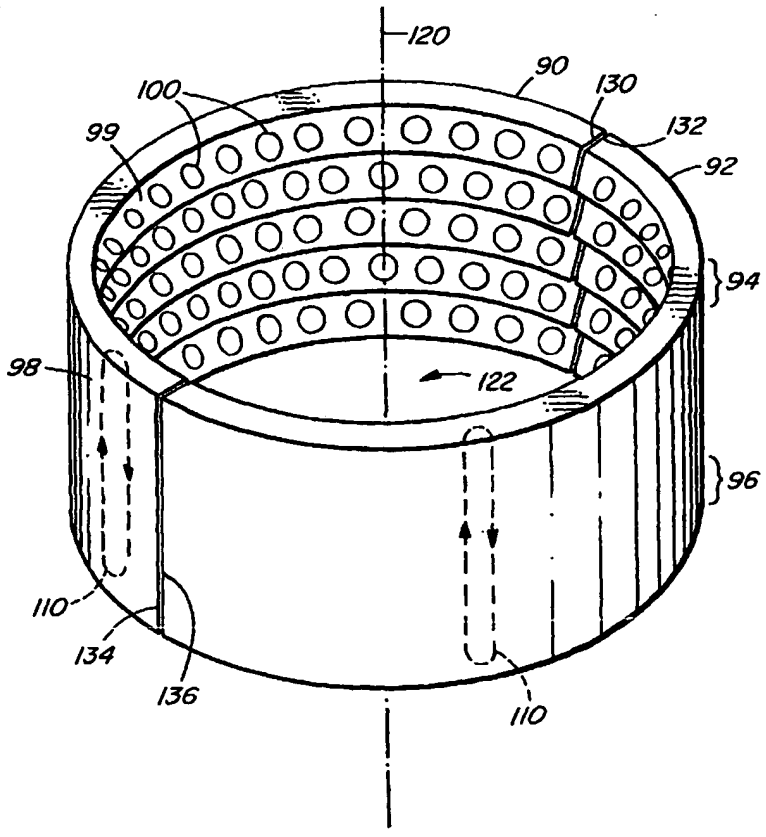

(57) Abstract: The present invention relates to a plant growth unit comprising one or more supporters (90, 92), a plurality of growth sites (100) supported by the supporters and means (110) for establishing a liquid nutrient flow. The supporters are radially disposable about a central vertical longitudinal axis (120) defining an internal space (122), adapted to accommodate a light source, between the one or more supporters and operable to form a generally closed perimeter around the internal space. The growth sites are radially disposed about the longitudinal axis and generally face the internal space when the one or more supporters are radially disposed about the longitudinal axis and forming the generally closed perimeter. The liquid nutrient flow is established by circulating the liquid nutrient to an upper portion (94) of each of the one or more supporters and past the growth sites to a respective lower portion (96) of each of the one or more supporters.

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PLANT GROWTH UNIT

FIELD OF THE INVENTION

The present invention relates to the field of plant growth units.

BACKGROUND OF THE INVENTION

A typical hydroponic plant growth system comprises a nutrient base and circulates a liquid nutrient through a cultivation portion wherein the plant seeds or young plants are anchored. For example, US Patent No. 5,502,923 discloses a hydroponic plant growth system which consists of a nutrient supply module base which supplies liquid nutrient to a series of vertically stacked prop modules, each prop module containing a number of plant growth sites. As liquid nutrient is pumped to each prop module, water is distributed to the plants grown therein.

US Patent No. 4,986,027 discloses a plant growth apparatus comprising a flexible tubular element wherein slits are provided for the growth of plants. A fluid nutrient is supplied to the root permeable material via a pump system, the fluid nutrient thereby being supplied to the plants.

Similarly, US Patent Nos. 5,440,836, 5,555,676, 5,918,416 and 4,033,072 all disclose vertical growing columns for growing a number of plants which are supplied water and nutrients through the use of nutrient solution pumps in the base of the respective apparatuses, which supply liquid nutrient to the top of the apparatuses. The liquid nutrient is supplied to the plants as the liquid travels from the top of the apparatuses to the bases.

Further, the prior art indicates that multiple vertical plant grow columns may utilize a single nutrient base. For example, US Patent No. 5,363,594 discloses a structure for a

vertically oriented plant growth unit having a plurality of vertical columns arranged to conserve horizontal floor space and utilize a common base for the supply of liquid nutrient.

One of the potential limitations of the growth units described above is that the various plants of the growth units may receive different types and amounts of light from whatever light source is utilized. The differences in light quality and quantity may result in a divergence in growth and quality between plants grown at various levels and on various sides of the vertical columns.

US Patent No. 6,178,692 discloses a lighting system for use with one or more vertical growing columns. The lighting system is mobile and can apparently be angled to provide for equidistant lighting to the plants at both the top and the bottom of the vertical growth column. However, it would appear that equidistant lighting is to be provided by the lighting apparatus to a single side of each growth column. Each vertical column apparently has plants growing on all sides of the vertical unit and therefore a single lighting unit would appear only to provide equidistant lighting to those plants which are somewhat facing the lighting unit. To provide equidistant lighting to all plants on the growing columns, it would appear that two lighting units are set up on either side of one or more growing columns and angled to provide top to bottom equidistant lighting on each side of the vertical grow columns, thereby providing equidistant lighting to all plants. In at least some embodiments, this system therefore appears to be limited by the requirement for multiple lighting units to create equidistant lighting to all plants.

Other patents which are representative of plant growth units which have been proposed include EP-A-0533939 and U.S. Patent No. 6,477,805.

SUMMARY OF THE INVENTION

In one aspect of the present invention, there is provided a plant growth unit comprising one or more supporters, a plurality of growth sites supported by the supporters and means for establishing a liquid nutrient flow. The supporters may be radially disposable about a central vertical longitudinal axis defining an internal space between the one or more supporters. The supporters may be operable to form a generally closed perimeter around the internal space, each of the supporters having an upper portion and a lower portion. The internal space may be adapted to accommodate a light source. The growth sites may be radially disposed about the longitudinal axis and generally facing the internal space when the one or more supporters are radially disposed about the longitudinal axis and forming the generally closed perimeter. The liquid nutrient flow may be established by circulating the liquid nutrient to the upper portion of each of the one or more supporters and past the growth sites to the respective lower portion of each of the one or more supporters, so that the liquid nutrient flow comes into contact with each of the growth sites.

In some embodiments two or more of the growth sites are approximately equidistant from the longitudinal axis. In other embodiments, at least of the two growth sites may supported by each supporter and any growth sites at generally the same vertical level are approximately equidistant from the longitudinal axis. A plant growth unit may include at least two supporters supporting at least two growth sites, with any growth sites at generally the same vertical level being approximately equidistant from the longitudinal axis.

In some embodiments, the supporters include a first half and a second half which together form a generally circular perimeter around the internal space. The first half and the second half may each support a plurality of growth sites, with at least some of the growth sites on each of the first half and the second half being horizontally spaced

apart from each other and with at least some of the growth sites on each of the first half and the second half being vertically spaced apart from each other. Any growth sites at generally the same vertical level may be approximately equidistant from the longitudinal axis. The plurality of growth sites on each of the first half and second half may form a plurality of generally horizontal rows, each of the horizontal rows having a plurality of growth sites.

Each of the one or more supporters may include a hollow wall having an inner side facing towards the internal space and an outer side facing away from the internal space. The inner and outer sides may define a hollow therebetween through which the liquid nutrient may pass. The growth sites may be supported by the inner surface so that roots of a plant located in one of the growth sites protrudes into the hollow. Each of the hollow walls may have a bottom on the lower portion so that the hollow wall is able to contain the liquid nutrient from which the liquid nutrient flow is established. In such an embodiment, the liquid nutrient flow establishing means may include one or more fluid connections, through which the liquid nutrient may pass, connecting the lower portion of each of the hollow walls to the respective upper portion of each of the hollow walls for establishing liquid nutrient flow. Such an embodiment may further include a tube extending along a horizontal length of the upper portion in the hollow of each of the hollow walls, each tube being connected to each of the respective one or more fluid connections, and one or more sprayers connected to each tube for misting roots extending into the hollow of each of the hollow walls.

In yet other embodiments, each of the one or more supporters may include a wall through which the growth sites are supported, so that roots of a plant located in one of the growth sites protrudes from the wall away from the internal space. In such an embodiment, the plant growth unit may further include a nutrient supply module. The liquid establishing means may include one or more sprayers in fluid communication with the nutrient supply module, the one or more sprayers misting roots protruding

from the wall, and one or more collecting devices adjacent to the lower portion of the one or more supporters. The collecting device may be operable to collect the liquid nutrient as it travels to the lower portion of the one or more supporters. The collecting device may also be in fluid communication with the nutrient supply module to allow for recirculation of the liquid nutrient flow.

In other embodiments, the one or more supporters may be adapted to allow one or more supporters from another similar plant growth unit to be stacked on top of the plant growth unit. Two or more similar plant growth units may be stacked on top of one another.

In some embodiments having two or more supporters, the supporters are free standing and moveable towards and away from a closed position wherein the supporters form the generally closed perimeter around the internal space. Where there are more than one supporters, two or more supporters may hinged to each other allowing for movement towards and away from the closed position.

The plant growth unit may further comprise one or more nutrient supply modules in fluid communication with the respective one or more supporters. The one or more nutrient supply modules may act as a base into which the respective supporters are located.

In another aspect, the present invention provides methods for growing plants in a growth unit. Supporting means may be disposed radially about a central vertical longitudinal axis, thereby defining an internal space between the supporting means, the internal space being adapted to accommodate a light source, and the supporting means having an upper portion and a lower portion. A plurality of growth sites may be introduced supported by the supporting means, the growth sites being radially disposed about the longitudinal axis and generally facing towards the internal space. A plurality of plants may be located in the growth sites and a liquid nutrient flow may

be established by circulating a liquid nutrient to the upper portion of the supporting means to the respective lower portion of the supporting means, bringing the liquid nutrient into contact with the roots of the plants.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate the embodiments of the invention,

Figure 1 is an isometric view of a plant growth unit according to an embodiment of the invention

Figure 2 is an isometric view of the plant growth unit of Fig.1 with the first and second halves separated

Figure 3 is a longitudinal cross-sectional of a half of the plant growth unit of Fig. 1

DETAILED DESCRIPTION

Referring collectively to Figures 1, 2 and 3, a plant growth unit according to an embodiment of the present invention is shown. The plant growth unit includes two supporters 90 and 92, a plurality of growth sites 100 supported by the supporters 90 and 92, and means for establishing a liquid nutrient flow 110.

The supporters in the embodiment shown comprise a first semi-circular half 90 and a second semi-circular half 92. When placed together, as shown in Figure 1, the first and second halves 90 and 92 are radially disposed about a central longitudinal axis 120 and define an internal space 122 between them. During operation of the plant growth unit the first half 90 and second half 92 form a closed circular perimeter around the internal space 122.

In the embodiment shown, the first and second halves 90 and 92 form a circular unit. The supporters do not have to be made of two semi-circular halves. In some embodiments, there may be a single supporter forming a generally closed perimeter around the internal space 122 or there may be more than two supporters. The supporters do not need to be curved to form a generally circular perimeter, but may be generally planar or curved in any number of ways, such that the generally closed perimeter formed by the supporters may take on any number of shapes radially disposable about the longitudinal axis 120. For example, any number of flat supporters may form a polygonal perimeter around the internal space 122.

The curvature of the semi-circular halves in the embodiment shown provide for all of the growth sites 100 to be equidistant from the longitudinal axis 120, allowing for generally equidistant lighting to all of the plants grown in such a unit. The supporters do not have to be curved as in the embodiment shown, but may take on a shape which allows for the formation of a generally closed perimeter around the internal space 122 while allowing for the plant growth sites 100 to be generally facing the internal space 122. In some embodiments, the supporters may be shaped to allow the growth sites 100 to be equidistant from the longitudinal axis 120. All of the growth sites 100 need not be equidistant from the longitudinal axis 120. In some embodiments, the growth sites 100 at generally the same vertical level are equidistant from the longitudinal axis 120.

The first and second halves 90 and 92 in the embodiment shown are generally vertically oriented and generally vertically straight. In alternative embodiments, the supporters do not need to be generally vertically oriented and/or vertically straight. The supporters may be angled in any direction, and at any degree. For example, the supporters may be tilted towards or away from the longitudinal axis 120. The supporters may also be of various appropriate curvatures or shapes. Appropriate curvatures or shapes of the supporters may be selected so as to maintain the other functional objectives of the various embodiments of the invention.

The internal space 122 in the embodiment shown in Figures 1 through 3 may be adapted to accommodate various types of light sources. The light source may be, for example, a tubular light source which can be supported, for example by hanging, vertically between the first and second halves 90 and 92 in the internal space 122. In some embodiments, for generally equidistant lighting and advantageous conditions for all plants growing in the growth unit, the tubular light source may be supported approximately along the longitudinal axis. Alternatively, the light source could be a series of bulbs supported vertically between the supporters in the internal space 122, in some embodiments the series of bulbs being aligned approximately along the longitudinal axis for generally equidistant lighting. A series of bulbs may, for example, be vertically supported hung by a chain, or other support, from, for example, a support beam. The light source could also, for example, be a bulb hung in the internal space, or supported in the internal space by the base along the longitudinal axis. Appropriate bulbs for use as a light source include 400watt Metal Halide, 400watt High Pressure Sodium, 250watt Metal Halide, 250watt High Pressure Sodium and 430watt Son Agro. Larger bulbs, such as 600watt High Pressure Sodium, 1000watt High Pressure Sodium or 1000watt Metal Halide, may also be used; however, when larger bulbs such as these are used as a light source for the plant growth unit, they may have to be continuously moved up and down the longitudinal axis when lit.

Each supporter 90 and 92 may have an upper portion 94 and a lower portion 96. The supporters 90 and 92 may be made of plastic or another suitable material, such as clay, metal or wood. The supporters 90 and 92 may, for example, be manufactured by way of known injection mold techniques, or extruding plastic techniques. The supporters 90 and 92 could alternatively be carved from wood, or other carvable material, or could be formed by gluing or nailing wooden planks together to form square columns. A supporter may also be formed from clay by shaping clay pieces and then mounting the clay pieces into a supporter.

Since the supporters 90 and 92 form a generally closed perimeter, this allows for a maximum number of growth sites 100 to be supported while maintaining equidistant lighting. Further, the generally closed perimeter prevents the escape of light from the light source(s) in the internal space, and provides thermal insulation to the plants as grown in the growth sites 100.

In the embodiment illustrated in Figures 1 through 3, the plant growth units 100 form five horizontal rows, each horizontal row having a plurality of growth sites 100. As illustrated, the plant growth sites 100 are generally equidistant from the longitudinal axis 120 and generally face towards the internal space 122. This provides generally equidistant lighting to all plants in the plant growth unit when a tubular light source is vertically supported along the longitudinal axis 120.

Each supporter may have any number of plant growth sites 100. Where each supporter has more than one growth site 100, the growth sites 100 may be vertically and/or horizontally spaced apart from each other. The growth sites 100 do not need to be arranged in horizontal rows, as shown in the illustrated embodiment, but can take any number of arrangements. Where the growth sites 100 are arranged in horizontal rows on the supporters, they can form any number of horizontal rows and each row can have any number of growth sites 100.

The growth sites 100 may be equidistant from the longitudinal axis 120 for equidistant lighting, even when the supporters themselves are not equidistant from the longitudinal axis 120. However, in some embodiments the present invention also contemplates a growth unit where the growth sites 100 are not equidistant from the longitudinal axis 120. For example, it may be necessary to have plants at different stages of development be closer or nearer the light source.

Where the growth sites 100 are vertically spaced apart on the supporters, those growth sites which are a generally the same vertical level may be equidistant from the longitudinal axis to provide advantageous lighting to all the plants where, for example, a single bulb, located along the longitudinal axis, is used as a lighting source. In such a growth unit, the growth sites vertically further away from the bulb may be situated closer to the longitudinal axis than those growth sites vertically closer to the bulb, in order that all plants receive equidistant lighting for advantageous conditions. Those growth sites at the same vertical level may therefore be equidistant from the longitudinal axis, even where not all growth sites in the growth unit are equidistant from the longitudinal axis. A variation in the distance of the growth sites from the longitudinal axis may be accomplished by tilting the supporters or designing the supporters to vary in distance from the longitudinal axis. Alternatively, the growth sites may protrude from the supporters at different lengths, varying the distance of the growth sites at different vertical levels to the longitudinal axis.

Since the supporters 90 and 92 form a generally closed perimeter, this allows for a maximum number of growth sites 100 to be supported while maintaining equidistant lighting. Further, the generally closed perimeter prevents the escape of light from the light source(s) in the internal space, and provides thermal insulation to the plants as grown in the growth sites 100.

The first and second halves 90 and 92, in the embodiment shown, are hollow walls having an outer side 98 and an inner side 99 defining a hollow 97 therebetween, as shown in Figure 3. The hollow 97 is adapted to allow for the liquid nutrient 112 to pass through it. In the embodiment shown, the hollow 97 is truly a hollow. However, in some embodiments, the hollow 97 may contain a suitable permeable material through which the liquid nutrient 112 is able to pass. Suitable planting medium includes, but is not limited to, Hydroton™ (or other small round, kiln heated clay types), Sunshine Mix™ (or other peat perlite soil like mixes), perlite, vermiculite, rockwool, washed rock, sand, foam or animal castings. The permeable material is

also not limited to planting medium. A wide range of materials is possible to use, where such material allows for the passage of the liquid nutrient flow 110 through the hollow 97, while still allowing the growth unit to meet the other functional objectives of the various embodiments.

In the embodiment shown, the hollow walls of the first and second halves 90 and 92 have bottoms 95 on the lower portion 96, enabling the hollow walls to contain the liquid nutrient 112, from which the liquid nutrient flow 110 is established. Thus, in the embodiment illustrated, the first and second halves 90 and 92 themselves act as a nutrient supply reservoir. As shown in Figure 3, a pump 114 circulates the liquid nutrient 112 from the lower portion 96 of the each of the first and second halves 90 and 92, through a tube 116, through a semi-circular tube 117 extending longitudinally along the upper portion 94 in the hollow 97, and out a plurality of sprayers 118. The liquid nutrient 112 then travels, in some embodiments by gravitational pull, through the hollow 97, past the roots of plants located in the plant growth sites 100 and back to the lower portion 96 of each respective half. In some embodiments, the growth sites 100 are vertically aligned so that the liquid nutrient drips through the roots of each respective aligned growth site to the growth site below. In alternative embodiments, a plurality of pumps may facilitate the liquid nutrient flow 112. Instead of a semi-circular tube 117, there may be a plurality of tubes 116 providing liquid nutrient 112 to the plant growth sites 100. In some embodiments, there may be a single sprayer 118 in each supporter; alternatively, each growth site 100 may be provided with a sprayer 118 for misting plan roots.

The pumps 114 may be, for example, Little Giant™ sump pump 1200gph, or other such pumps manufactured by Magdrive™ and Rio™. The tubes 116 and 117 may be, for example, ½ inch commercial garden hose, ½ inch rubber garden hose, ½ inch ABS hose or other size hoses of the same type. The system connecting the tubes 116 and 117 to the supporters 90 and 92 and the pump(s) 114 may incorporate ABS elbows, ABS stop plugs, hose clamps, rubber washers, ½ inch ABS tees, ½ inch shut off

values and female to male hose adaptors, arranged to facilitate the liquid nutrient flow 110. Other types of fluid connectors are also contemplated by the present invention.

Alternative means for establishing the liquid nutrient flow 110 are also contemplated. For example, a pump may be located near the upper portion 94 of the supporters 90 and 92 to pull the liquid nutrient 112 from the lower portion 96. The tubes 114 and 116 do not have to be inside the supporters 90 and 92, but may connect the lower portion 96 to the upper portion 84 of each of the supporters 90 and 92 on the outside of the supporters 90 and 92. The present invention contemplates such other means for establishing the liquid nutrient flow.

The liquid nutrient 112, need not be contained within the hollow wall. In some embodiments, there may be provided one or more nutrient supply modules in fluid communication with the one or more hollow walls. The nutrient supply module is designed to contain the liquid nutrient 112. The nutrient supply module may act as a base for the plant growth unit, thereby stabilizing the hollow walls contained therein, and may be appropriately shaped for maintaining balance and support of the plant growth unit. In some embodiments, each hollow wall has its own nutrient supply module which may act as a base for each respective hollow wall. In some embodiments where the nutrient supply module acts as a base, the hollow wall may have a hole in the lower portion such that the liquid nutrient flow may pass out of the lower portion into the nutrient supply module. In alternative embodiments, the hollow wall may not have a bottom and the hollow wall may be supported above the bottom of the nutrient supply module for the liquid nutrient to pass out of the hollow wall.

When present, the nutrient supply module may take on various shapes adapted to enable it to act as a nutrient supply module in fluid communication with the supporters 90 and 92. Where the nutrient supply module is intended to act as a base

for the growth unit, it may be designed to maintain balance and support of the growth unit when placed on its intended surface.

Where the nutrient supply module acts as a base, the nutrient supply module may have a hole in the upper portion of the nutrient supply module located approximately at the longitudinal axis 120, such a hole being adapted to hold a mesh basket for collecting medium and dead foliage to later be discarded, and allowing excess liquid nutrient 112 to pass into the nutrient supply module. It is not necessary that the nutrient supply module have such a hole. The outer portion of the upper surface of the nutrient supply module may also slope downwardly towards the longitudinal axis 120, allowing excess liquid nutrient 112 dripping from the supporters 90 and 92 to drain towards the longitudinal axis 120 and the hole which may be present in the nutrient supply module. The upper surface of the nutrient supply module may also be level, or may slope in other directions.

The nutrient supply module may be made of plastic, such as food grade polyethylene or food grade polycarbonate. The nutrient supply module may be manufactured by, for example, placing food grade polyethylene powder in an aluminum mold, which is then heated and rotated on two separate axes. The food grade polyethylene in the mold melts as the mold is heated and the centripetal force of the rotation forces the melted plastic to the walls of the aluminum mold where it cools as the mold is removed from the heat. The nutrient supply module is then removed from the mold. In alternative embodiments, the nutrient supply module may be manufactured from a variety of other materials capable of containing the liquid nutrient 112 and allowing for fluid communication with the supporters 90 and 92.

In the embodiment shown in Figures 1 through 3, the supporters are hollow walls. However, the supporters do not need to be hollow walls. In alternative embodiments, the supporters are relatively narrow walls through which the plant growth sites 100 are supported. The roots of plants planted in such a supporter would extend from the

wall on the outer side of the wall away from the internal space, being open to the surrounding environment rather than contained within a hollow in the wall. In such an embodiment, the liquid nutrient flow 110 may be established by including in the growth unit a separate nutrient supply module in fluid communication with one or more sprayers. The liquid nutrient may be pumped out the sprayers to mist the roots of the plant roots protruding from the outside of the supporter. In some embodiments, the plant growth unit would also include one or more collecting devices adjacent to the lower portion of the one or more supporters for collecting the liquid nutrient as gravity pulls it down past the plant roots. Such a collecting device may be in fluid communication with the nutrient supply module to allow for re-circulation of the liquid nutrient. In other embodiments, the nutrient supply module may act as a base, as described above, which collects the liquid nutrient as it travels to the lower portion of each supporter.

In the embodiment as illustrated in Figures 1 through 3, the growth sites 100 protrude upwardly from the supporters 90 and 92 in order to facilitate anchoring plants at the growth sites 100. The growth sites 100 in the embodiments illustrated angle upwardly at approximately a forty-five degree angle. The growth sites 100 may protrude from the supporters 90 and 92 at alternative angles, however the angle will preferably be chosen as one appropriate to maintain plants in growth sites. The present invention also contemplates a growth unit where the growth sites 100 do not protrude from the supporters 90 and 92.

In the embodiment shown, the growth sites 100 form a unitary part of the inner side 99 of the hollow walls of the first and second halves 90 and 92. The invention also contemplates a growth unit where the growth sites 100 are not formed as a part of the supporters 90 and 92, but are later attached to the growth unit as separate components.

The growth sites 100 shown in the illustrations have circular openings into which plants may be anchored and grown. The present invention is not limited to growth

sites which have circular openings for receiving the plants. The growth sites may take various forms which would allow for a plant to be grown. For example, the various shapes and sizes of planting pots as normally found in the field of gardening may be used as growth sites, the size being limited of course by the size of the growth unit. Accordingly, a wide variety of types of growth sites that could be used in growth units are contemplated by this invention.

In the embodiments shown in Figures 1 through 3, the growth unit includes baskets 102 which fit into the circular openings of the growth sites 100. The baskets 102 may be designed to hold plants. The baskets 102 may be made of plastic or another suitable material. In the embodiment shown, the baskets 102 are open weave baskets. The plants sit in the baskets 102 and the plant roots protrude through the bottom of the baskets. The present invention also contemplates other means for retaining the plants in the growth sites. For example, the hollow 97 of the supporters 90 and 92 may contain a planting medium into which the plants may be anchored and grown.

Each growth site 100 may be positioned to contact the liquid nutrient flow 110. The plants may be located in the baskets 102, which are placed in the growth sites 100, and the plant roots protrude from the base of the baskets 102. The plant roots are therefore located within hollow 97 of the supporters 90 and 92. As the liquid nutrient flow 110 is established through the hollow 97, the liquid nutrient flow 110 will come into contact with the plant roots.

There are other means for positioning the various types of growth sites such that the plant roots will come into contact with the liquid nutrient flow. For example, where the hollow 97 contains planting medium into which the plants are anchored at the growth sites 110, the roots of the plants will come into contact with the liquid nutrient flow as it travels through the planting medium.

In the embodiment shown in Figures 1 through 3, the hollow wall of the first half 90 has closed ends 130 and 134, and the hollow wall of the second half 92 has closed ends 132 and 136. The first and second halves 90 and 92 are free standing in the embodiment shown. During operation, the first ends 130 and 132 are adjacent to one another and the second ends 134 and 136 are adjacent to one another, as shown in Figure 1, to form a closed perimeter around the internal space. However, the first ends 130 and 132 and the second ends 134 and 136 are able to be moved towards and away from each other, as shown in Figure 2, to allow access the growth sites 100. The first and second halves 90 and 92 may be hinged at the first ends 130 and 132 or the second ends 134 and 136 to allow a person to open and close the perimeter around the internal space from one side. Such hinging may facilitate the stability of the plant growth unit, particularly where the supporters are free standing. Where a plurality of supporters are present, two or more may be hinged to each other. The supporters may further include devices to facilitate moving the supporters towards and away from the closed perimeter position. For example, the bottom of the supporters may have wheels or tracks which allow for such movement.

The plant growth unit as shown in Figures 1 through 3 may be adapted to allow for stacking of similar plant growth units on top of one another. Any number of plant growth units may be stacked on top of one another to utilize vertical space without taking up additional horizontal space. The plant growth unit may include structural features that allow for stable stacking between similar units, or a locking mechanism to hold the units together. For example, there may be provided knobs which screw to the top of the bottom unit to the bottom of the upper unit to lock the units together. There may also be provided a H-shaped locking device that fits between an upper and lower unit, the cross of the H-shaped device sitting between the two units and the arms of the H-shaped device preventing lateral movement between the units.

Various types of liquid nutrient 112 may be used. The liquid nutrient may contain essential elements needed for plant growth, such as Nitrogen, Phosphorus, Calcium,

Magnesium, Sulphur, Iron, Potassium, Boron, Manganese, Zinc, Copper, and Molybdenum. For example, GGold Nutrient Line™ or General Hydroponics Flora Line™ contain these essential elements needed for plant growth and therefore may be used as the liquid nutirent. The quality, quantity and type of liquid nutrient used will vary depending on many factors, such as the type and age of the plants being grown. The liquid nutrient should be chosen with a view to establishing advantageous growth conditions.

The present invention also contemplates a method for growing plants where a plant growth unit as described above is provided, plants are planted into the growth sites and a liquid nutrient flow is established.

While specific embodiments of the invention have been described and illustrated, such embodiments should be considered illustrative of the invention only and not as limiting the invention as construed in accordance with the accompanying claims.

WHAT IS CLAIMED IS:

1. A plant growth unit comprising:

(a) one or more supporters radially disposed about a central vertical longitudinal axis defining an internal space between the one or more supporters, the internal space being adapted to accommodate a light source, the supporters operable to form a generally closed perimeter around the internal space, each of the supporters having an upper portion and a lower portion;

(b) a plurality of growth sites supported by the one or more supporters, the growth sites being radially disposed about the longitudinal axis and generally facing the internal space; and

(c) means for establishing a liquid nutrient flow by circulating the liquid nutrient to the upper portion of each of the one or more supporters and past the growth sites to the respective lower portion of each of the one or more supporters, so that the liquid nutrient flow comes into contact with each of the growth sites.

2. A plant growth unit as claimed in claim 1, wherein two or more of the growth sites are approximately equidistant from the longitudinal axis.

3. A plant growth unit as claimed in either claim 1 or 2, wherein at least two growth sites are supported by each supporter, wherein any growth sites at generally the same vertical level are approximately equidistant from the longitudinal axis.

4. A plant growth unit as claimed in any one of claims 1 to 3 comprising at least two supporters and wherein at least two growth sites are supported on each supporter, any growth sites at generally the same vertical level being approximately equidistant from the longitudinal axis.

5. A plant growth unit as claimed in any one of claims 1 to 4, wherein the supporters comprise a first half and a second half which together form a generally circular perimeter around the internal space.

6. A plant growth unit as claimed in claim 5, wherein the first half and the second half each support a plurality of growth sites, at least some of the growth sites on each of the first half and the second half being horizontally spaced apart from each other and at least some of the growth sites on each of the first half and the second half being vertically spaced apart from each other, any growth sites at generally the same vertical level being approximately equidistant from the longitudinal axis.

7. A plant growth unit as claimed in claim 6, wherein the plurality of growth sites on each of the first half and second half form a plurality of generally horizontal rows, each of the horizontal rows having a plurality of growth sites.

8. A plant growth unit as claimed in any one of claims 1 to 7, wherein each of the one or more supporters comprise a hollow wall having an inner side facing towards the internal space and an outer side facing away from the internal space, the inner and outer surfaces defining a hollow therebetween, the growth sites being supported by the inner surface so that roots of a plant located in one of the growth sites protrudes into the hollow.

9. A plant growth unit as claimed in claim 8, wherein each of the hollow walls has a bottom on the lower portion so that the hollow wall is able to contain a liquid nutrient from which the liquid nutrient flow is established.

10. A plant growth unit as claimed in either claim 8 or 9, further comprising a nutrient supply module capable of containing a liquid nutrient, the module being in fluid communication with each of the one or more hollow walls.

11. A plant growth unit as claimed in any one of claims 1 to 10, wherein the liquid nutrient flow establishing means comprises one or more fluid connections, through which the liquid nutrient may pass, connecting the lower portion of each of the hollow walls to the respective upper portion of each of the hollow walls for establishing liquid nutrient flow.

12. A plant growth unit as claimed in claim 11, further comprising one or more sprayers associated with each hollow wall, the one or more sprayers being connected to each of the fluid connections for misting roots in the hollow of each hollow wall.

13. A plant growth unit as claimed in claim 12, further comprising a tube extending in the hollow along a horizontal length of the upper portion of each of the hollow walls, each tube being connected to each of the respective one or more sprayers and connected to each of the respective one or more fluid connections.

14. A plant growth unit as claimed in any one of claims 1 to 13, further comprising at least one pump facilitating the liquid nutrient flow.

15. A plant growth unit as claimed in any one of claims 1 to 6, wherein each of the one or more supporters comprise a wall through which the growth sites are supported, so that roots of a plant located in one of the growth sites protrudes from the wall away from the internal space.

16. A plant growth unit as claimed in claim 15, wherein the containing means comprises a nutrient supply module and wherein said liquid nutrient flow establishing means comprises:

(a) one or more sprayers in fluid communication with the nutrient supply module, the one or more sprayers misting roots protruding from the wall; and

(b) one or more collecting devices adjacent to the lower portion of the one or more supporters, the collecting device operable to collect the liquid nutrient as it travels

to the lower portion of the one or more supporters, the collecting device being in fluid communication with the nutrient supply module to allow for circulation of the liquid nutrient flow.

17. A plant growth unit as claimed in any one of claims 1 to 16, wherein the growth sites protrude upwardly from the supporters.

18. A plant growth unit as claimed in claim any one of claims 1 to 17, further comprising a plurality of baskets adapted to hold plants and attachable to the growth sites.

19. A plant growth unit as claimed in claim any one of claims 1 to 18 wherein the one or more supporters are adapted to allow one or more supporters from another similar plant growth unit to be stacked on top of the plant growth unit.

20. A plant growth unit as claimed in claim 19 wherein the one or more supporters are stacked with one or more supporters from another similar plant growth unit.

21. A plant growth unit as claimed in claim 19 wherein the one or more supporters are stacked with a plurality of one or more supporters from another similar plant growth unit.

22. A plant growth unit as claimed in claim any one of claims 1 to 21, wherein said supporters are free standing.

23. A plant growth unit as claimed in any one of claims 1 to 22, wherein said supporters are free standing and moveable towards and away from a position wherein the at least two supporters form the generally closed perimeter around the internal space.

24. A plant growth unit as claimed in any one of claims 1 to 23, wherein the containing means comprises one or more nutrient supply modules in fluid communication with the respective one or more supporters.

25. A plant growth unit as claimed in claim 24, wherein the one or more nutrient supply modules is a base into which the respective supporters are located.

26. A plant growth unit as claimed in claim 25, wherein the nutrient supply module is a base into which the one or more supporters are located.

27. A plant growth unit as claimed in claim 4, wherein the at least two supporters are hinged to each other allowing for movement towards and away from a position wherein the at least two supporters form the generally closed perimeter around the internal space.

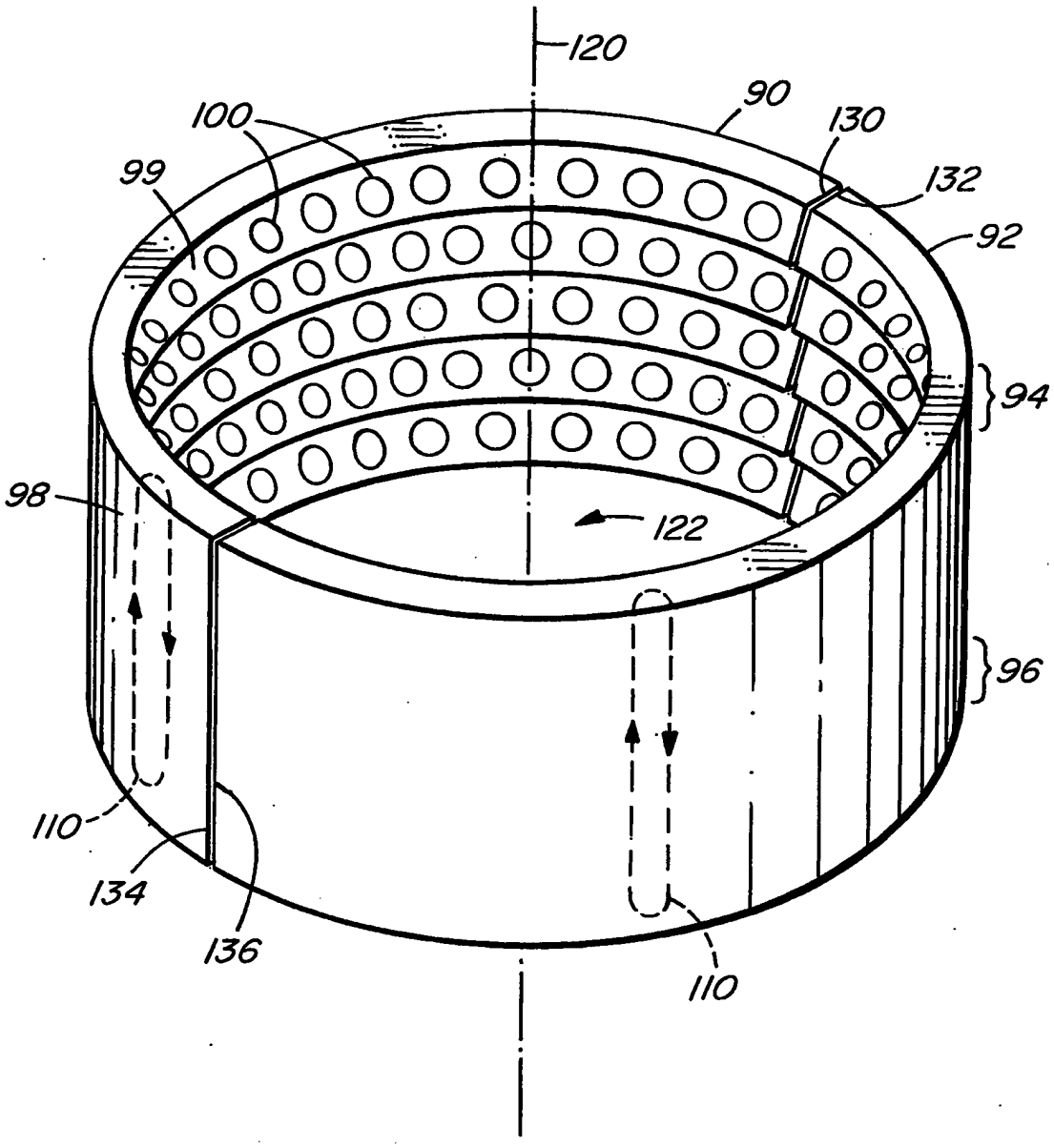

FIG. 1

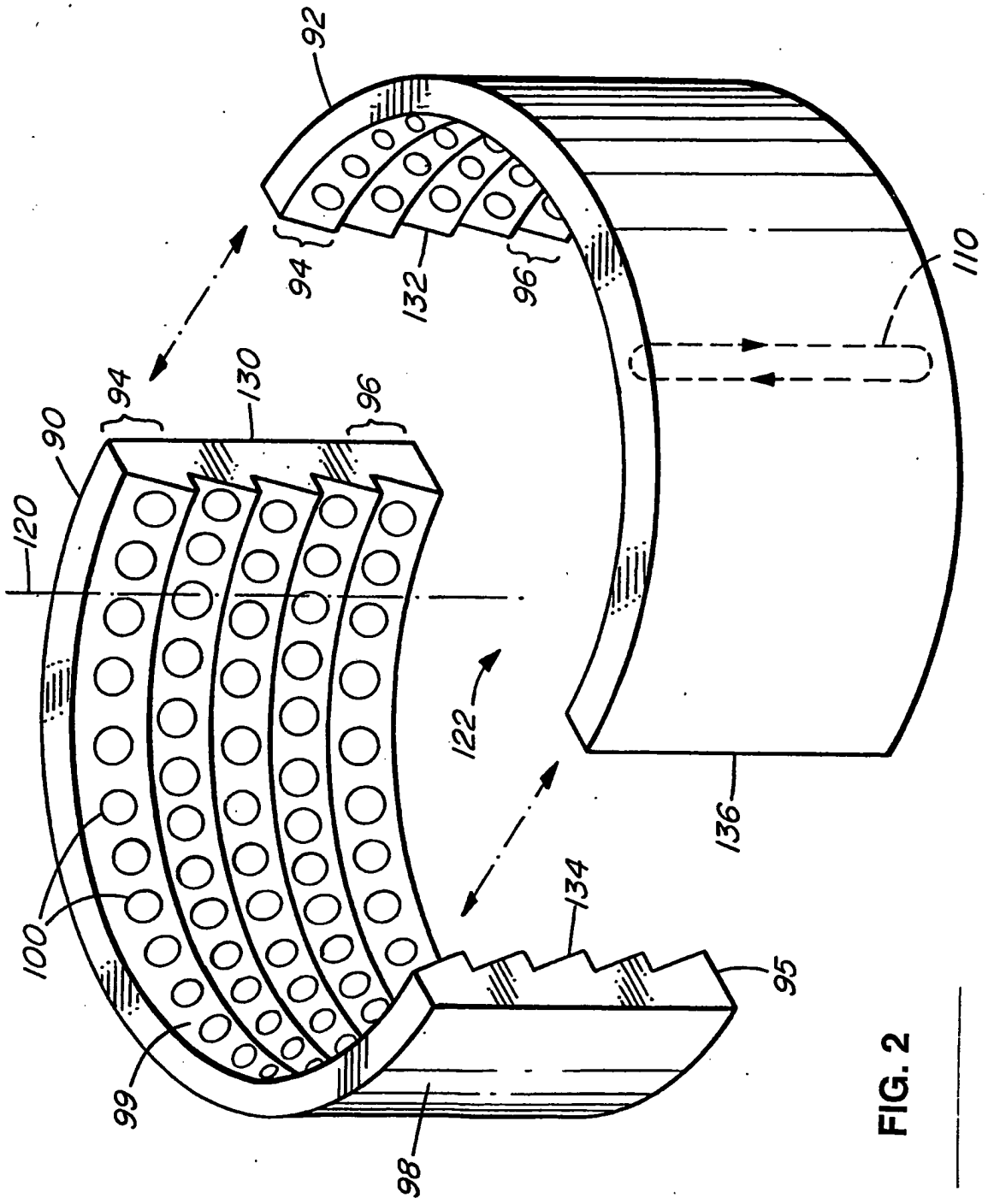

FIG. 2

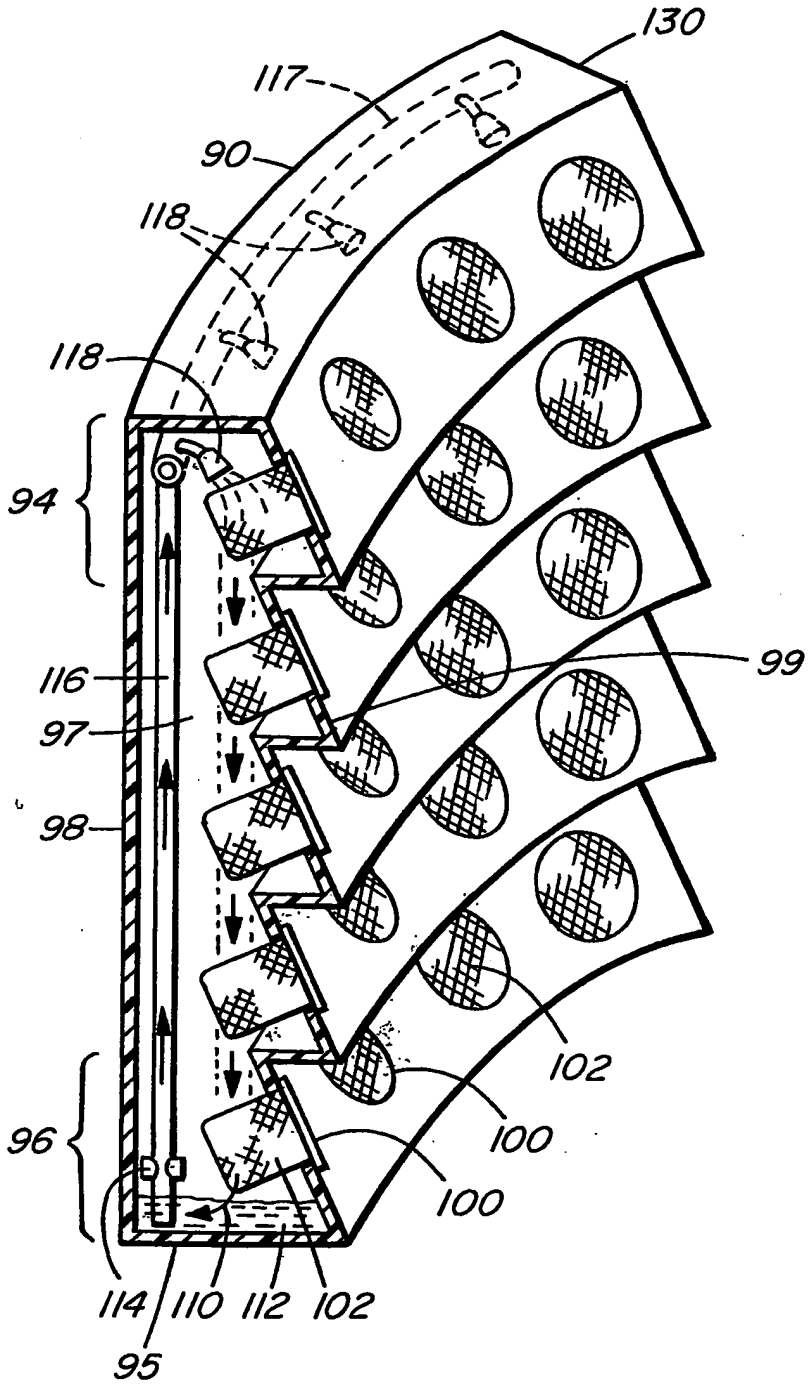
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FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 03/00644

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01G9/02 A01G31/02 A01G31/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 37 29 218 A (HARTENBACH MONIKA) 16 March 1989 (1989-03-16) column 2, line 33 - line 37 column 3, line 6 - line 17; figures	1-4, 19-23 14,24-26
Y	US 6 178 692 B1 (GRAVEN ROBERT E) 30 January 2001 (2001-01-30) cited in the application column 8, line 29 - line 56; figure 7	14,24
A Y	US 2002/040548 A1 (WARE LARRY AUSTIN) 11 April 2002 (2002-04-11) cited in the application paragraph '0036!; figures	1-4, 8-11,14, 15,17,24 25,26

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 July 2003	23/07/2003

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 03/00644

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00 33642 A (BENNETT MANFRED ;GARRETT GRAHAM RICHARD (NZ)) 15 June 2000 (2000-06-15) page 6, paragraph 2 - paragraph 3; figure 3	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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